Comparison of Transurethral use of Nephroscope with Cystoscope in Transurethral Cystolithotripsy

Sistolitotripside Transüretral Nefroskop Kullanımının Sistoskop ile Karşılaştırılması

Nefroskop Kullanarak Sistolitotripsi / Cystolitotripsy Using Nephroscope

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Özet

Amaç: Amacımız büyük mesane taşlarının tedavisinde transurethral yoldan amplatz kılıf aracılığı ile nefroskop kullanımının ve transurethral sistoskop kullanımının etkinliği ve güvenilirliğini karşılaştırmaktı. Gereç ve Yöntem: Çalışmaya 3 cm. den büyük mesane taşı olan 46 erkek hasta dahil edildi. Hastalar 2 gruba randomize edildi.Grup 1'deki 24 hastanın taşı transurethral Amplatz kılıf ile beraber nefroskop kullanılarak kırılırken, grup 2'deki 22 hastanın taşı transüretral sistoskop kullanılarak tedavi edildi. Taştan temizleme oranları postop 2. günde direk üriner sistem grafisi (DÜSG) çekilerek değerlendirildi. Olası üretral darlığı ekarte etmek için bütün hastalara post op 3. ayda üretrografi ve üroflowmetri yapıldı. Sonrasında hastalar DÜSG ve ultrasonografi ile 6 ay aralıklarla değerlendirildi. Bulgular: Tüm hastalarda taş parçaları tamamen temizlendi. Grup 1'deki hastalarda üretral giriş sayısı grup 2 hastalara gore anlamlı derece daha azdı. Grup 1 ve 2 için operasyon zamanları sırası ile 42.00 ± 7.30 dk. ve 59.14 ± 10.62 dk. idi (P ≤0.0001). Ortalama operasyon süresi grup 1 için anlamlı olarak kısaydı. Takiplerde hiçbir hastada üretral darlık gelişmedi. Tartışma: Büyük mesane taşlarının transüretral amplatz kılıf kullanarak nefroskopla tedavisi sistoskop kullanmına göre hızlı ve etkili bir tedavi yöntemidir.

Anahtar Kelimeler

Mesane; Nefroskop; Sistoskop; Taş

Abstract

Aim: Our aim was to compare the efficacy and safety of transurethral use of a nephroscope via Amplatz sheet with the transurethral use of cystoscope for the treatment of large bladder stones. Material and Method: A total of 46 male patients with a bladder stone ≥3 cm were included. Patients were randomized into two groups. Group 1 consisted of 24 patients whom bladder stone was fragmented by the transurethral use of a nephroscope via 26F Amplatz sheath and Group 2 consisted of 22 patients who were treated by the transurethral use of a cystoscope. Stone clearance was assessed by the KUB film at the second postoperative day. At the postoperative third month, retrograde urethrogram and uroflowmetry was done on all patients to evaluate the possible postoperative urethral stricture. Thereafter, all patients were followed up by the KUB film and ultrasonography for every 6 months. Results: All stone fragments were removed completely in every patient. Access number within the Amplatz sheath in group 1 was significantly lower than the transurethral access number in group 2. The mean operative time for stone removal in group 1 and 2 was 42.00 ± 7.30 min and 59.14 ± 10.62 min, respectively (P ≤0.0001). The mean operative time for stone removal was significantly shorter in group 1. During the follow-up period, none of the patients developed urethral stricture nor recurred. Discussion: Treatment of large bladder stones by a nephroscope via transurethrally placed Amplatz sheath is a fast and effective treatment modality compared to endoscopic treatment via cystoscope.

Keywords

Bladder; Cystoscope; Nephroscope; Stone

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Introduction

Bladder stones, generally affecting men, account for 5% of urinary stones and usually occur because of bladder outlet obstruction (BOO), neurogenic voiding dysfunction, infection or foreign bodies [1-3]. Mixed types constitute the most common form of bladder stones [4]. In the presence of infection struvite is the major constituent but uric acid and calcium oxalate stones are also common [4].

Accepted modalities in the treatment of bladder stones include open cystolithotomy (OC), extracorporeal shockwave lithotripsy (SWL), transurethral cystolithotripsy (TUCL) and percutaneous suprapubic cystolithotripsy (PCCL). With the recent technological advances, minimally invasive procedures such as SWL, TUCL and PCCL have become the most preferred treatment alternatives in the management of bladder stones. Stone size and constituent, patient's age, previous history of treatment for bladder stones, body structure of the patient, accompanying diseases, treatment cost and preference of the surgeon are the factors used for determining the treatment modality [5].

Several lithotripsy devices such as electro-hydraulic, holmium laser, ultrasonic and pneumatic lithotripters are used for the endoscopic fragmentation of bladder stones [6-9]. Despite this variety of operative approaches and modalities of lithotripsy, the management of large calculi can sometimes be challenging and time consuming. These minimally invasive surgical procedures significantly increased the success rates of bladder stone treatment however, complication rates and operation time change according to the treatment modality. In these surgical techniques, bladder stones were removed via transurethral or suprapubic routes [9]. Generally, intervention through transurethral way is made by using a cystoscope or nephroscope [10]. In TUCL procedure, removing the fragmented stones from the bladder is time consuming part of the surgery and also the determinant factor for resultant complication.

In this randomized and prospective study, our objective was to compare the efficacy and safety of transurethral use of a nephroscope via Amplatz sheet with the transurethral use of cystoscope for the treatment of large bladder stones.

Material and Method

Between February 2009 and April 2010, patients admitted to urology outpatient clinic with the complaints of irritative urinary symptoms were evaluated. All patients were evaluated with medical history and physical examination, routine laboratory tests (serum creatinine, complete blood count, coagulation profile and serum prostate specific antigen), routine urinalysis and microscopy, urine culture and sensitivity, uroflowmetry, ultrasonography of the urinary tract and radiography of the kidney, ureter and bladder (KUB). A total of 46 male patients with a bladder stone ≥3 cm were included in the study. Largest diameter of the stones were measured by the KUB film. Patients with a history of pelvic radiotherapy, bladder tumor, prior abdominal surgery, stone at another side of the urinary tract, renal insufficiency, hydronephrosis, urinary infection, and urinary retention were excluded from the study.

A total of 46 patients underwent TUCL. Patients were randomized into two groups. Group 1 consisted of 24 patients whom bladder stone was fragmented by the transurethral use of a nephroscope via 26F Amplatz sheath (24F Olympus nephroscope, 26F Amplatz sheath) and Group 2 consisted of 22 patients who were treated by the transurethral use of a cystoscope (23 F R.Wolf cystoscope). Combined pneumatic-ultrasonic lithotripsy device (Lithoclast Master Electro-Medical Systems, Nyon, Switzerland) was used in all patients for stone fragmentation. All procedures were performed by the same surgeon (A.T.O) under general anesthesia in the lithotomy position. In both groups, one dose of second generation cephalosporin was administrated preoperatively. In group 1, initially nephroscope was placed into the Amplatz sheath and both sheath and nephroscope were inserted through the urethra together at one setting, under the direct vision (Figure1). Amplatz sheath was not removed till the end of the procedure. Stone in the bladder was fragmented by the lithotriptor and all stone particles were removed by a stone grasper through the Amplatz sheath which was removed at the end of the procedure. (Figure2,3). In group 2, the cystoscope was inserted through the urethra under the direct vision. All the stone in the bladder were fragmented to small pieces and removed through the cystoscope sheath or the urethra. In both groups, 16 F urethral catheter was inserted to the bladder at the end of the procedure and removed at the second postoperative day.

Two of the patients in both groups who have urethral stric-

Figure 1. Placement of amplatz sheath into urethra

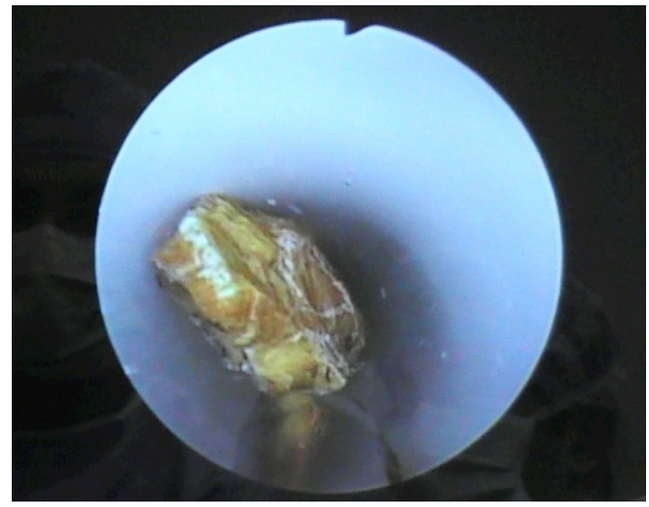

Figure 2. Extracting the stones through the amplatz sheath

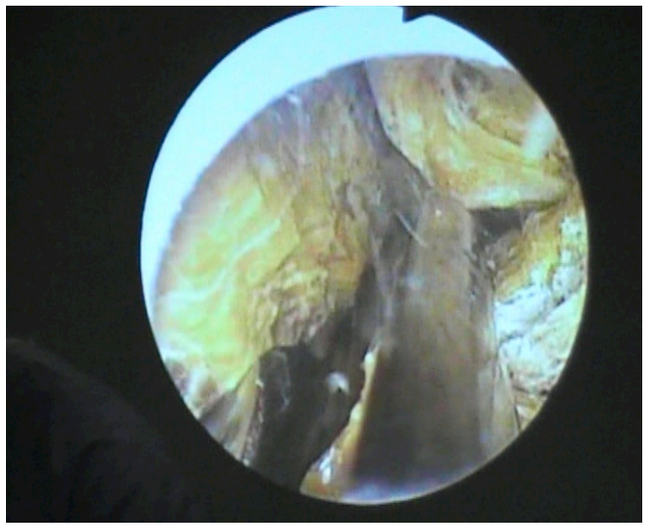

Figure 3. Extracting the stones through the amplatz sheath

ture, were subjected to internal urethrotomy before the stone fragmentation procedure. Similarly, 4 patients in group 1 and 3 patients in group 2 were found to have benign prostatic hyperplasia (BPH). After the stone fragmentation procedure, transurethral resection of prostate (TUR-P) were performed on these patients. Time spent for TUR-P and urethrotomy was not included to the total operation time.

Stone clearance was assessed by the KUB film at the second postoperative day. Stone free status was defined as disappearance of stone fragment images on the KUB film. At the postoperative third month, retrograde urethrogram and uroflowmetry was done on all patients to evaluate the possible postoperative urethral stricture. Thereafter, all patients were followed up by the KUB film and ultrasonography for every 6 months, for an average of 23.22 ± 7.87 months.

Statistical analyses were performed using SPSS 11.5. Stone clearance, operation time, transurethral access numbers and operative complications were compared between the groups using Mann Whitney U test. Statistical significance was set as "p<0.05".

Written informed consent was obtained from all patients prior to the study inclusion. The study was approved by Ethical Committee of Ankara Atatürk Training and Research Hospital.

Results

The characteristics and operative parameters are summarized in Table 1. There was no statistically significant difference in age (P = 0.912), stone size (P = 0.869) or follow-up period (P = 0.873) in both groups. The underlying cause of bladder stone was urethral stricture in 4, BPH in 7 and idiopathic in the remaining patients.

All stone fragments were removed completely on every patient. In group 1, one transurethral access was made via Amplatz sheath throughout the entire procedure. Access number within the Amplatz sheath in group 1 was significantly lower than the transurethral access number in group 2 (P = 0.018, Table 1). The mean operative time for stone removal in group 1 and 2 was 42.00 ± 7.30 minutes (min) and 59.14 ± 10.62 min, respectively. The mean operative time for stone removal was significantly shorter in group 1 (P ≤ 0.001, Table 1).

Table 1. Patients characteristics and operative results

	Group 1 (n=24)	Group 2 (n=22)	p* value
Age (years)	49.58 ± 9.50	49.95 ± 11.38	0.808
Stone size (cm)	4.34 ± 0.78	4.28 ± 0,55	0.869
Follow-up period (months)	20.16 ± 6.51	23.22 ± 7.87	0.250
Operation time (minutes)	42.00 ± 7.30	59.14 ± 10.62	<0.0001
Transurethral acces number (mean)	18.12 ± 4.94	26.81 ± 3.14	<0.0001

*Mann-whitney u test

Intraoperatively, one of the patients in group 1 and 2 in group 2 had abrasion of the urethral mucosa without major bleeding. These minor mucosal damages in 3 patients were healed spontaneously by urethral catheterization. Urethral catheters of all patients in any groups were inserted at the end of the procedure and removed at the second postoperative day. No other intraoperative complication such as bleeding, bladder perforation was observed in both groups. None of the patients developed urethral stricture nor recurred during follow-up. Preoperative and postoperative mean uroflowmetry values in both groups were presented in Table 2.

Table 2. Preoperative and postoperative uroflowmetry results of both groups

Mean Maximum Urine Flow Rate (Qm) (ml/sn)			
	Preoperative Qm (ml/sn)	Postoperative third month Qm (ml/sn)	p* value
Group 1 (n=24)	15.05±3.82 (range 8.0 to 19.8)	16,72±1.74 (range 14.8 to 20.0)	0.076
Group 2 (n=22)	15.12±3.64 (range 8.5 to 20)	16.78±1.45 (range 14.7 to 20.5)	0.078

*Mann-whitney u test

Discussion

There are various treatment modalities for the management of large bladder stones such as OC, SWL, TUCL, and PCCL. OC has been used for a long time for the management of bladder stones with a high success rate. Today it is a rarely used method. In recent studies, comparing the effectivity of OC with endourological procedures in treating large bladder stones, it was concluded that OC has a 100% stone-free rate at one setting, similar operation time but a longer hospital stay [9,11]. Nowadays, OC should be the main treatment modality in patients with heavy stone burden, abnormal anatomy preventing safe access for endourological methods or who are undergoing open prostatectomy and diverticulectomy [12,13]. SWL for bladder stones appears to be simple, well tolerated and effective. However, stone size limits the efficacy of SWL, the passage of residual fragments is prolonged, it is not possible to remove especially the large stones with only one intervention and usually necessitates ancillary endoscopic procedures [13-15].

Nowadays, endoscopic treatment of bladder stones is the most commonly used minimally invasive method. In all endoscopic procedures for the treatment of bladder stones, the main purpose is to achieve a stone-free status with a short operation time and without any complications. Therefore, different endoscopic techniques and devices are described for the treatment of large bladder stones. Several studies evaluated the efficacy of PCCL, which uses the principles of percutaneous access and

tract dilatation, developed for endourologic surgery. Tzortzis et al [16] performed PCCL in 31 patients with bladder stones larger than 2 cm and concluded that PCCL was a safe and effective technique to remove bladder stones. In another study, the effectivity of PCCL was evaluated in 155 children with bladder stones and the authors decided that PCCL was safe and effective [17]. Sofer et al [18] presented a combined technique of percutaneous suprapubic and transurethral route in 12 patients with bladder stone larger than 4 cm. They suggested that this combination might be useful to immobilize rolling stones through one route, for effective fragmentation through another route. In their study including 14 patients with BPH and large bladder stones, Aron et al [19] demonstrated PCCL and TUR-P was more advantageous than TUCL and TUR-P in terms of operation time and morbidity. However, the percutaneous approach needs an incision, a suprapubic tube which should be inserted directly or under ultrasonographic view, and have a risk of bowel perforation and vascular injury [20].

TUCL is probably the most common way to manage bladder stones. Transurethral intervention in TUCL is generally performed by a cystoscope. This approach permits the use of various devices such as mechanical stone crusher, electrohydraulic, ultrasonic, pneumatic and laser lithotripters [2,3,6,21]. Transurethral treatment of large and/or multiple bladder stones by the cystoscope can be time consuming because different lithotripters can be used and manuplation has the potential to cause urethral injury especially during the active removal of residual fragments [22]. In the case of performing TUCL by the cystoscope, the removal of larger stone fragments should necessitate to pull the cystoscope out together with the stone. Fragmented stones may damage the urethra during this process, especially when they escaped from the stone grasper, because the surgeon would need to perform an additional maneuver to grasp or fragment the stone in the urethra. Furthermore, recurrent insertions of cystoscope after every removal of fragmented stone will increase the risk for urethral injury. To avoid from these risks, Amplatz sheath is used for transurethral intervention. Maheshwari et al [23] presented a technique of TUCL with the use of Amplatz sheath for transurethral intervention in women with bladder stones. They have placed the Amplatz sheath through the urethra after urethral dilatation at the beginning of the procedure, then fragmented the stone(s) and removed the fragments through this Amplatz sheath. They reported a significantly shorter operation time and concluded that this TUCL technique was safe and effective. In another study, authors demonstrated a transurethral intervention method by a nephroscope via Amplatz sheath for the treatment of large bladder stones in men. After the urethral dilatation up to 30 F, they have inserted the Amplatz sheath through the urethra and placed the nephroscope inside the sheath. They have fragmented the stone(s) by an ultrasonic lithotripter and removed the fragments through this sheath. Authors concluded that the use of Amplatz sheath in TUCL facilitates the removal of large stone fragments and the irrigation of residual fragments [19].

In our randomized and prospective study, we compared the efficacy of transurethral use of nephroscope via Amplatz sheath and transurethral use of cystoscope for the TUCL of bladder stones larger than 3 cm. We did not use any urethral dilatation in group 1. We placed Amplatz sheath through the urethra with the nephroscope inside it, at one setting and did not remove till the end of the procedure. In both groups, stone-free rates were 100% and the complication rates were similar. Main differences between the two groups were in operation time and transurethral access numbers. In group 1, the mean operation time for stone removal was significantly shorter and the access number within the Amplatz sheath was lower than the group 2. Our limited experience shows that collecting the large stone fragments via Amplatz sheath, prevents from multiple entries to the urethra and protects the tract from a possible damage caused by large stone fragments.

However, our study has some limitations: i) we have not had the patients' uroflowmetry results repeated after the third month of the follow-up period. We agree that these results would help to provide objective confirmation of the lack of urethral stricture. ii) We admit that the sample size of our study was relatively small. We believe that series are required to confirm our results.

Conclusion

Treatment of large bladder stones by a nephroscope via transurethrally placed Amplatz sheath is a fast and effective treatment modality compared to endoscopic treatment via cystoscope. Amplatz sheath facilitates collection of large stone fragments, prevents from multiple entries to the urethra and protects the tract from a possible damage caused by large stone fragments.

Competing interests

The authors declare that they have no competing interests.

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